

BALD EAGLES WINTERING IN THE SOUTHERN GULF ISLANDS, BRITISH COLUMBIA

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THIS study represents the first attempt to census regularly the wintering Bald Eagles *Haliaeetus leucocephalus* in the southern Gulf Islands, British Columbia. Data were also collected on the feeding and hunting habits of the wintering eagles. In 1961 the National Audubon Society initiated its 5-year Continental Bald Eagle Study. This North American survey was prompted largely by the alarming decrease in numbers of the eastern Bald Eagle in recent years. The studies of Broley (1947), Howell (1962), and others have amply pointed out the plight of this great bird in the eastern United States. More recently Southern (1963) conducted a survey of the Bald Eagles wintering along the Mississippi River in northwestern Illinois. No similar studies have been conducted on the west coast prior to the Continental Bald Eagle project, or to my study.

Murie (1940 and 1959) described the food habits of the eagles of the Aleutian Islands, and Dixon (1909) gives a brief history of the Alaskan birds. Brooks (1922) and Munro (1938) presented a few of their observations on the feeding and hunting habits of Bald Eagles in British Columbia. Less important notes on individual sightings, nestings, and feeding incidents complete the literature on this species on the west coast.

METHOD

Fifteen aerial counts, involving 24 hours and 15 minutes of flying time, were conducted over the area (Fig. 1) from 26 September 1962 to 18 April 1963. In addition, 130 hours were spent on ground observations. The study area (shown in Fig. 1) is encompassed by 48°33' and 48°45' north latitude and 123°30' and 123°15' west longitude. This represents those southern Gulf Islands lying east of the Saanich Peninsula, Vancouver Island, B. C., and west of the United States border. About 50 square miles of land and water were covered. The two-member flight crew consisted of an observer-recorder, and myself as pilot-observer. A two-seater seaplane (Luscombe) was used. The flight speed varied from 75–100 mph. The aircraft was flown around the shoreline of each island at between 75 to 175 feet. In addition, the larger islands, Moresby, Portland, Sidney, Coal, and Piers Islands, were contoured at quarter-mile intervals—at about 100 feet above the treetops. The study transect represented that area extending outward approximately 250 yards from either side of the airplane. Birds were recorded in approximate locations on

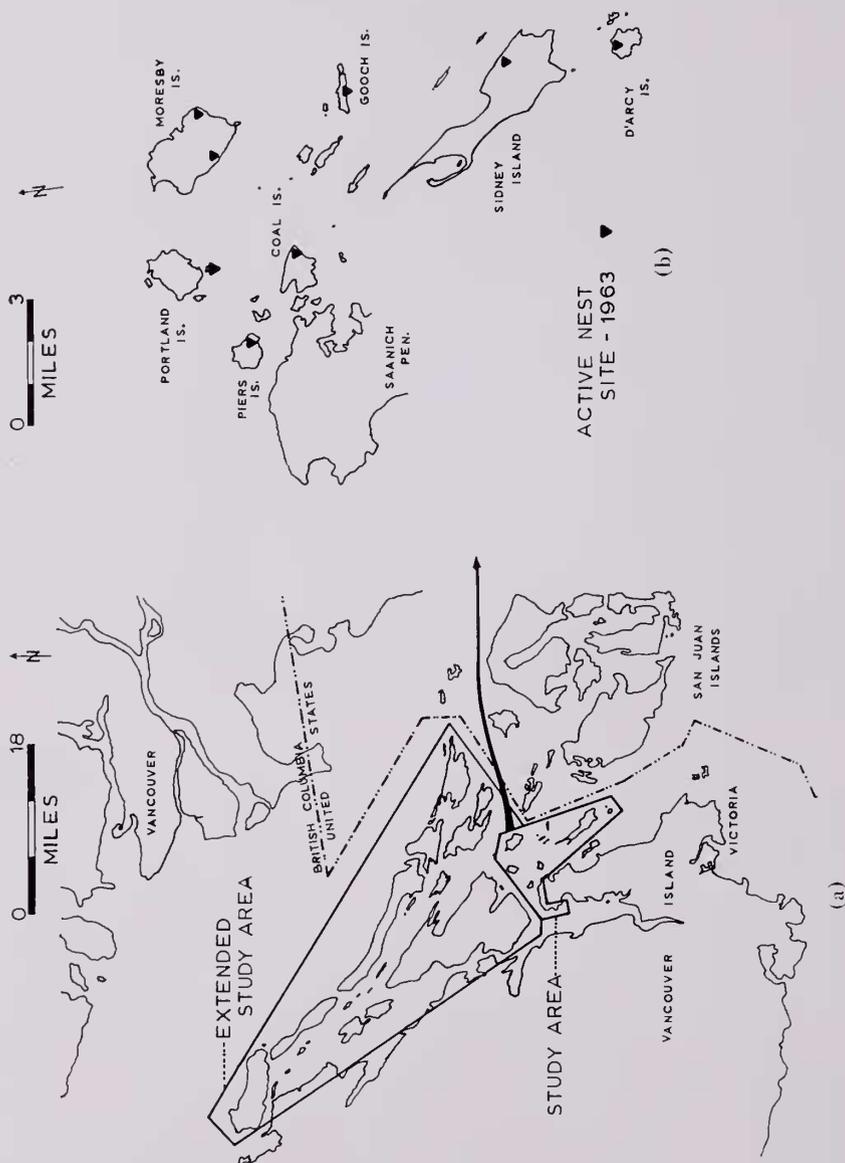


FIG. 1. (a) Map of study areas. (b) Large-scale map of study area showing active nest sites.

work maps, according to age, and whether they were observed sitting or flying.

During February four additional flights (9 hours flying time) were carried out to assess the wintering eagle populations of some of the remaining Gulf Islands. On these flights most of the major shorelines were covered, but many of the small bays and much of the inland area were overlooked. Table 1 lists the major islands covered and gives the actual number of birds seen, along with my estimation of how many birds were actually present. This estimate allows for both the areas that were not flown and for the underestimation due to the difficulty in spotting the birds. This area encompassed about 500 square miles and is referred to as the extended study area. Table 1 also shows the results from a census flight over San Juan Island, U.S.A. My estimate of total birds present in the San Juan group unfortunately is based on very little data. Breeding density and productivity will be dealt with in a later paper.

There is undoubtedly some inaccuracy in determining the age class ratios (adults to immatures). The white head and the black body of the adult birds make their presence more conspicuous than the duller and more mottled immatures. In addition, ground and aerial observations suggest that immatures more often perch in the lower limbs of trees than do the adults, and are thus less easily viewed from the air. It therefore seems likely that more immatures are missed than adults, but that flying adults and flying immatures are spotted with equal ease. Of the birds observed flying, 19 were adults and 26 were immatures. Therefore, if we assume the group of birds observed sitting and the group observed flying are both represented equally by the ratio of adults to immatures in the total population, we can conclude first that adults and immatures represent approximately 40 and 60% of the population respectively. Second, assuming for the moment that the sitting adult population (219) is correct, we would then expect to have observed about 300 sitting immatures. Only 110 sitting immatures were observed. On this basis we can say we observed only about 40% of the immatures present. This line of reasoning has two major drawbacks. First, it assumes that the time spent sitting and flying by each age-group is proportional. Second, it assumes that the adult count is correct, when, in fact, some adults were probably overlooked. This would have made the error even larger. I doubt that the bias is as large as suggested by the above reasoning. Errors due to duplication are considered negligible. As a result of more recent aerial and water counts I have reached the conclusion that my censusing technique for the transect underestimates the adult age-class by not more than 10-15% and the immature class by about 20-35%. While my method underestimates the actual eagle

TABLE 1
PEAK COUNTS AND FORECASTS OF TOTAL BALD EAGLES WINTERING IN THE GULF ISLANDS,
B.C., AND SAN JUAN ISLANDS, WASH. 1962-63*

	Date	Peak counts			Forecasts		
		Ad.	Imm.	Total	Ad.	Imm.	Total
GULF ISLANDS, B.C.							
Study area	12 Feb.	29	33	62	33	45	78
Saltspring	9-16 Feb.	10	5	15	25	20	45
Prevost	9 Feb.	8	1	9	13	8	21
North Pender	20 Feb.	4	1	5	10	8	18
South Pender	20 Feb.	2	0	2	4	4	8
Saturna	20 Feb.	11	6	17	22	20	42
Mayne	20 Feb.	8	5	13	13	12	25
Galiano	20 Feb.	19	6	25	31	20	51
Kuper	-	-	-	-	7	7	14
Thetis	-	-	-	-	8	8	16
Valdes	-	-	-	-	10	10	20
Gabriola	-	-	-	-	10	10	20
Approximate total of estimated wintering population:					175	175	350
Population density \cong 0.7 Bald Eagle per square mile							
SAN JUAN ISLANDS, WASH., U.S.A.							
San Juan	7 Feb.	22	13	35	30	30	60
Remaining islands	7 Feb.	-	-	-	50	50	100
Approximate total of estimated wintering population:					75	75	150

* Totals are given for each major island and this includes the small nearby islands.

population, the relative seasonal changes in abundance are reliable since the censusing technique has remained constant throughout the study.

SEASONAL MOVEMENTS

The change in abundance is shown by Fig. 2. Several population movement patterns have become apparent. At the onset of the project, on 26 September 1962, no eagles were present in the study area. The first bird was observed in the area by Darcy Goyette (pers. comm.) at Piers Island on 21 October. My count of 24 October found nine adults present. A local naturalist, Jack Todd (pers. comm.), spent from 12-18 October on Sidney Island and did not see an eagle. Therefore, I feel that the date of the eagles' arrival on the study area is about the third week in October. Not only were the first birds to arrive adults, but these adults in many cases appeared paired and were located in the vicinity of nest sites. It is my opinion that the first birds to arrive on the "winter territory" were the breeding adults of that territory. During the months of November and December the eagle population remained relatively stable (10-17 adults and 0-2 immatures). The eight nest sites

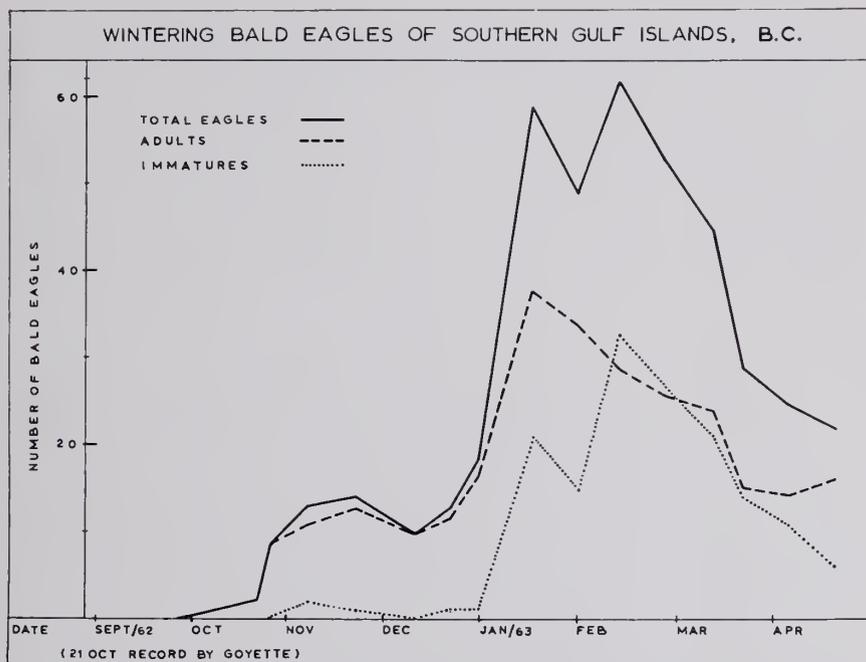


FIG. 2. Wintering Bald Eagles of Southern Gulf Islands, B. C.

known in the study area could nearly account for all these adult birds. It might be pointed out that in most cases it was the presence of the adult birds near the nests that made the nests conspicuous.

Between 31 December 1962 and 16 January 1963, the population increased from 18 to 59 birds. This new group of birds was composed nearly equally of adults and immatures. This high population of birds was maintained in the study area from the first of January until the latter part of February, after which a steady decline in numbers was noted.

The adult segment of the population began to decline after the middle of January. The maximum count of 38 adults was made on 16 January. On 14 March only 24 adults were seen. After this date all the adults present on the study area (the number varying between 14 and 16) can again be accounted for by assuming they are the breeding birds of the eight active nests of the area censused (Fig. 1b).

The population changes of the immature age-class varied only slightly from those of the adults. The arrival of the immatures on the study area probably coincides with that of the first adults, although the first birds were not actually noted on the study area until 7 November. From zero to two birds were noted

between November and December. On 16 January, 21 immatures were seen—this increase coincides with the period of the adult increase. Between 16 January and 14 March the count of immature eagles varied between 15 and 33, the latter count being on 12 February. The large variation in number is probably partially attributable to the difficulty in detecting the immature birds. Daily movements and congregations around temporary food supplies also contribute to the variation in such a small study area. From the last week of March on into the summer the population of immatures gradually declined. Six immatures were present on 18 April.

DISCUSSION

While this study has provided the ground work for a more advanced population study of the Bald Eagle and has outlined the population changes that have occurred in a 50-square-mile area in the southern Gulf Islands during the winter months, little knowledge has been gained which will help interpret the changes observed. While much has been learned about the migratory habits of the southern Bald Eagle through efforts of the late C. L. Broley, no similar work has been done on the northern Bald Eagle. Robbins (1960), in a summary of western Bald Eagle band returns, pointed that there are insufficient data available to determine migratory patterns. Alaskan returns have all been winter recoveries of locally banded birds. Two California recoveries were of birds banded as nestlings in Yellowstone National Park, Wyoming, and Great Slave Lake, N.W.T. Therefore, direction and extent of migrations are largely conjecture at present.

Winter concentrations of Bald Eagles are reported from the Klamath Basin and Snake River Plains and are known by this study to occur in the coastal archipelago of Washington and British Columbia. Whether coastal birds are moving inland or whether the Klamath concentration is due to an accumulation of northern interior birds remains to be seen, though the latter seems more reasonable. The changes observed by Southern (1963) in his study of eagles wintering in northwestern Illinois show a striking parallel to those I encountered. However, the buildup and subsequent decline of adult Illinois birds occurred about 3 weeks in advance of that of the West Coast birds.

POPULATION DENSITY

On the date of the highest count, 12 February, the population density was one bird per 0.81 square mile of island and water area for the 50 square miles of study area. There are several reasons why the density found on the small area does not, nor should, agree with that found on the remaining 500 square miles of archipelago which had only 1 bird per 3.37 square miles. First, only part of the extended study area was actually censused and therefore only

a fraction of the birds were counted. Second, the smaller area is composed of many small islands which have a proportionately longer shoreline than many of the larger islands in the extended area. Few eagles are found at distances greater than 400 yards from the sea, with most birds being within 50 yards of it. The few exceptions were birds feeding on sheep or deer carcasses, or birds soaring or presumably just landed after riding updrafts to the higher inland centers of the island. Another factor which works to upset the rather regular distribution of the Bald Eagle is the periodic change in local abundance of food supply. For example, Sidney and Moresby Islands both had temporarily high concentrations of eagles associated with sheep carcasses. Once the carcasses were consumed the eagles dispersed. On the other hand, San Juan Island regularly supports a large wintering eagle population. This island is unique in that rabbits, in addition to sheep, are important food items.

The general picture that emerges is that the entire Gulf Islands and the northern San Juan Islands support a relatively high density of Bald Eagles throughout the winter and early spring months. The density is probably in excess of one bird every 2 square miles over the whole area. The age-class ratio changes markedly with the season. Since the British Columbia coast is relatively uninhabited and since the Bald Eagle is present in the area in fairly high numbers, it seems reasonable to suppose that this study is being conducted on a relatively healthy and stable population. Sprunt (1961) has suggested that it would be interesting to compare age-class ratios of a healthy population to that population which exists in the eastern and southern United States. Such a comparison poses many problems. One must know more about the migratory patterns of the different age-classes. When Florida birds are breeding the northern birds are on winter range. Since the age-class structure of the West Coast birds varies so markedly both temporally and spatially and since an even larger geographic variation in age ratios was noted by Southern (1963) in Illinois, it seems pointless to place much value on this comparison at this time. The same argument holds true for a comparison of my peak January count with that of the Audubon January census which probably censuses the United States eagle population during its maximum period. The decreased productivity of the Bald Eagle in the United States in recent years should be reflected by a low immature to adult ratio. An average of the 1961 and 1962 January Audubon counts yields a ratio of about 27 immatures to 73 adults. My West Coast count of 16 January 1963, gives an immature to adult ratio of about 36 to 64 respectively. My peak count on 12 February gives the ratio as 53 to 47. It must be remembered that my immature class is probably low due to the differential age bias in counting. This comparison, if valid, suggests that the United States population is declining. However, a quantitative measure of this decline is not possible with the data available.

FOOD

The most prominent food item in the diet of the wintering eagles in the 50-square-mile study area is dead sheep. All of the larger concentrations of eagles were associated with sheep carcasses. For example, on 27 February 14 adults and 15 immatures were observed perched around one 200-acre field containing three partially eaten sheep carcasses. Usually only one bird would feed at a time while two or three more would be perched on nearby rocks and fence posts. Over the past 6 years the local sheep rancher and myself have spent hundreds of hours observing these eagles from blinds. Never once have we witnessed an attack or attempted attack by an eagle on young lambs or on ewes giving birth. The accusation by some of the farmers that the eagles are killing sheep seems completely unfounded and is probably based upon observations of eagles feeding on already dead sheep. I have seen eagles fly not more than 6 feet above a ewe giving birth and the eagles showed no sign of aggressiveness nor the ewe of fright. However, once the ewe and her lamb had withdrawn a few yards from the area an eagle would come down to gorge upon the afterbirth. The conservation-minded sheep rancher considers these scavengers an asset, not a threat.

In areas where there were no sheep carcasses the eagles were more evenly dispersed. This even distribution is probably an adaptation whereby maximum density can be supported by a passive exploitation of the environment. Observations over the past 6 years suggest that a major proportion of the Bald Eagle's hunting is done from a perch. Suitable perches usually overlook several miles of shoreline. Either the prey makes itself conspicuous to the eagle, as in the case of schooling fish or ducks swimming by, or the sea exposes the food on the beaches. Eagles are highly opportunistic, like most raptors, and readily congregate where food is in surplus. Some hunting is also carried out from soaring flights. While sheep constitute a major food item in some localities, fish caught live and found dead appear to be the normal diet. Crustacean shells are sometimes found in the castings.

At Sidney Island Lagoon, a favourite shooting area, several adult and immature eagles regularly hunted waterfowl. On 22 January 300 widgeon and teal were flushed out of the shallow water by the airplane. Immediately one adult and two immature eagles were observed attacking a crippled widgeon. Seventeen passes were made in rapid succession by the three eagles and each time the widgeon dove to safety, creating considerable spray. When the eagles tired and returned to perches the widgeon swam from the shallow (18 inches deep) to deeper water. This pattern of activity was repeated several times throughout the winter, with usually three or four eagles working simultaneously at one duck. I witnessed 85 passes at crippled waterfowl and never once saw an eagle make a successful strike. However, the speed with which

the eagles approach their prey suggests that such attacks might occasionally be successful. No eagle was observed attacking a healthy duck.

The Gulf Islands also support a large population of wintering Peregrine Falcons (*Falco peregrinus pealii*). On 20 January, again at Sidney Lagoon, I saw an adult female peregrine catch a female Bufflehead and carry it to a log on the sand spit. No sooner had she landed than she was forced into the air by an attacking immature Bald Eagle. While the falcon was attempting to drive away the eagle the duck returned to the water and swam off.

The San Juan Islands represent a unique situation in that feral rabbits form an important food item. Both abundance of food species, and previous experience or preference, would appear largely to determine what is eaten. In some areas, eagles, presumably the same birds, were often seen hunting waterfowl. In other areas waterfowl were left and only fish taken. For example, the pair of adult eagles wintering and breeding on Discovery Island regularly capture Glaucous-winged Gulls. This prey species is abundant throughout the whole region but is regularly captured only by a few eagles.

SUMMARY

1. Twice-monthly aerial surveys have been conducted over 50 square miles of the southern Gulf Islands, British Columbia, between 26 September 1962 and 18 April 1963.
2. The first birds arrived on the study area about the third week of October.
3. The adults that arrived between October and the end of December are thought to represent those adults which breed within the area. Few immatures were present during this period.
4. During the first 2 weeks of January the eagle population nearly tripled—this new group being composed equally of adults and immatures.
5. The adult population declined after the middle of January. The immature population increased until the middle of February, after which it declined.
6. Factors affecting the accuracy of the aerial censusing techniques are discussed.
7. Nine additional hours of surveys over an extended area (500 sq mi) yielded a density of one bird per 3.37 square miles. The actual wintering density during peak population in February, is probably just under one bird per square mile over the entire Gulf Island area. The small study area yielded a density of one bird per 0.81 square mile for the peak population on 12 February.
8. Eagles are generally perched within 50 yards of the sea, and their distribution along the coast is quite regular. Clumping was associated regularly with congregations of eagles around sheep carcasses.
9. Dead sheep constitute a major food item for the wintering eagles on several of the Gulf and San Juan Islands. Throughout most of the Gulf Islands, however, fish appear to be the major food item. Few birds are captured.

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